

Photo mementos: designing digital media to represent ourselves at home

PETRELLI, Daniela <<http://orcid.org/0000-0003-4103-3565>>, BOWEN, Simon and WHITTAKER, Steve

Available from Sheffield Hallam University Research Archive (SHURA) at:
<http://shura.shu.ac.uk/7960/>

This document is the author deposited version. You are advised to consult the publisher's version if you wish to cite from it.

Published version

PETRELLI, Daniela, BOWEN, Simon and WHITTAKER, Steve (2014). Photo mementos: designing digital media to represent ourselves at home. *International Journal of Human-Computer Studies*, 72 (3), 320-336.

Copyright and re-use policy

See <http://shura.shu.ac.uk/information.html>

Photo Mementos: Designing Digital Media to Represent Ourselves At Home

Daniela Petrelli
Art & Design Research Centre
Sheffield Hallam University
Cantor Building – 153 Arundel Street
Sheffield
S1 2NU – UK
d.petrelli@shu.ac.uk

Simon Bowen
Art & Design Research Centre
Sheffield Hallam University
Cantor Building – 153 Arundel Street
Sheffield
S1 2NU – UK
s.bowen@shu.ac.uk

Steve Whittaker
University of California at Santa Cruz
Psychology Department
High St
Santa Cruz CA, 95064, USA.
swhittak@ucsc.edu

Abstract

We examine photos in the family home as examples of *mementos*, cherished objects kept in memory of a person or event. In a 'memory tour', we asked participants to walk us through their family home selecting and discussing significant mnemonic objects. With each personal narrative we recorded memento location, i.e. the room, place within the room and any nearby objects. Although photos were not the most popular mementos, when chosen they were highly significant, and often unique. These photo mementos were usually not representational but symbolic, where only the owner knows their many layers of meaning. Photos from different times in the person's life were strategically placed in different rooms. Their location afforded different functions, e.g. photo mementos in family spaces reinforced family bonds, photo mementos in personal spaces were for immersive reminiscing, whereas those in public rooms had an aesthetic value and to spark conversations with visitors. Finally photo mementos were rarely isolated: they were clustered in displayed albums or stored with other memorabilia in boxes or drawers to represent a stage in life. We explore the implications of these findings by designing potential new home photo technologies, looking at how new designs might support the types of behaviours observed. Through four conceptual designs we examine how photo technology might integrate into the practices and aesthetic of the family home. The concepts led to a set of concluding considerations that need to be taken into account when designing new forms of display technology that are part of a larger domestic photo system.

1. Introduction

In more than a century of practice, photos have been the subject of investigation in philosophy, anthropology and sociology. The meaning of photos and the role of photography in human history have been investigated in cultural studies. Photography is a multifaceted medium that supports human activities as diverse as: documenting reality for historical purposes (social history); expressing, provoking and communicating one's feelings (photography as art); supporting and spreading a commodity culture (advertisements) (Wells 2004). Although photography may seem to

be an objective capturing of reality, it is not neutral as it reflects the photographer's values and viewpoint (Price 2004).

Since the early days of photography personal pictures have played an important role in the *domestic* environment. "Home photography was not for public display, but for fun amongst friends" (Holland 2004, p. 118). The formal albums of the Victorian middle-classes may have evolved into a (more or less organized) collection of snapshots of the 'Kodak' generation, but the essence of home photography has not changed. Amateur photographers create an individual view, deciding how to represent themselves and the world around them. Chalfen (1987) showed that even in a domestic context, photographs reconstruct a partial view of reality, following a number of social constraints and expectations, e.g. photos tend to be of 'happy memories' even in time of deep economic crisis. Photos should therefore be interpreted as "cultural artefacts surrounded by social and cultural context" (Chalfen, 1987, p.161). Similar arguments on the semiotic value of photos as situated artefacts are put forward by Edwards and Hart (2004). Photos, particularly those to which we give prominence through framing and display, have a physical presence; they are image-objects with a function beyond the recording of events and relationships or the deliberate sharing of experiences in social settings (Edwards and Hart 2004). Indeed, photos are often on display at home to construct identity: "photos serve the purpose of preserving the memory of personal ties" (Csikszentmihalyi and Rochberg-Halton 1981). By persistent display, photos become part of the fabric of our homes and contribute to *autotopographies*. An autotopography (Gonzalez, 1995) is a "private-yet-material memory landscape ... made up of the more intimate expressions of values and beliefs, emotions and desires that are found in the domestic collection and arrangement of objects" (Gonzalez, 1995, p. 133). "In the creation of an autotopography – which does not include all personal property but only those objects seen to signify an 'individual' identity – the material world is called upon to represent a physical map of memory, history and belief. The autobiographical object thus becomes a prosthetic device: an addition, a trace, and a replacement for the intangible aspects of desire, identification, and social relations." (Gonzalez, 1995, p. 134)

The work reported in this paper follows Chalfen (1987) and Edwards and Hart (2004) in making arguments that photos must be understood in context of their display, together with other objects in place, and interpreted through the values expressed by their owner. Understanding photos in context is essential for our goal of identifying principles for the design of digital photo technology that integrates with the home and supports people in expressing their values. Not all personal belongings become part of an autotopography, and likewise not all personal photographs carry the same type of meaning. Our attention here is not directed toward all personal photos or all forms of display. Instead we focus on those few photos specifically selected as important, highly affective and expressing value: "The photographs that we keep for ourselves [] are treasured less for their quality than for their context and for the part they play in confirming and challenging the identity and history of their users." (Holland, 2004, p. 117). Our field study was designed to go beyond exhaustive enumerations of domestic objects and their functions such those collected by Csikszentmihalyi and Rochberg-Halton (1981).

Our participants selected and described their own mementos while walking through the different rooms of their home. This self-directed approach, with the participants leading the tour, the self-selection of objects and their directing the conversation engendered rich personal narratives, allowing affect and emotion to emerge. This approach is motivated by autobiographical memory studies (Brockmeier 2010) that see narrative as core, as the main way personal experiences are communicated to others and to ourselves: "We are at once authors and reader of our stories [] As readers we are continuously re-exploring the significance of earlier episodes of the story in light of what transpires later" (Lambek and Antze 1996). A rich, self-directed narrative is essential for the interpretation of a memento that is the anchor of the memory into the material world and acts as mediator between past and present, the self and the others (van Dijk 2007). The photographs discussed in this paper have the same expressive symbolic properties: they are artefacts, three-dimensional objects, deliberately made and collected, having a role in building identity and maintaining connections (Edwards and Hart 2004). The openness of our approach allows the "user" of the picture to do the talking: "Users bring to the image a wealth of surrounding knowledge. Their own private pictures are part of a complex network of memories and meaning with which they make sense of their daily life." (Holland 2004, p. 117).

There are two main contributions of this paper. The first is the new data and analysis we present about how photographs function in an ecology of personal objects that express memory and identity in the home, unpacking the role photographs play in this context. We collect and analyse expressive participant narratives about these complex sets of contextualised personal photos. That analysis shows how *type* of pictures, the display *location* and its *function* are all interrelated. The second contribution is to use this analysis to generate *new design concepts* for innovative display devices and systems for the home, reflecting on general principles for such technology. This complex network of physicality and meanings is instrumental to the conceptual designs we put forward to illustrate principles for a more affective relation between people and their personal digital photos in domestic spaces.

The paper is structured as follows. In the next section we review HCI work on digital photos. Section 3 describes the field study: the methodology, the data collection, and a summary of results. Section 4 discusses the findings in detail, every subsection covering a topic, namely: the role of photos as mementos; the relation between different formats of photo display (or photo concealment) and their meaning for the owner; the relation between location and use; and the importance of the home aesthetics for the development of digital photo technology. Section 5 describes how design was used to further explore our insights into home practices around photo mementos, and the four conceptual designs we produced. Section 6 discusses general implications for the design of domestic digital photo display technology, combining insights from the field study and design work. Section 7 concludes the paper.

2. Related Research on Personal Digital Photography

Digital photography has excited the interest of researchers since its inception. We review aspects of the huge literature most directly related to this paper: techniques for photo management; the social dimension of digital photos; and digital photo displays at home.

2.1 Systems for capturing, organising and retrieving photos

Much research in computer science has focused on new systems to support users in organizing and retrieving personal digital photo collections.. Central to these systems is the idea of capturing context to facilitate later retrieval. Early research used the metadata available on the camera, e.g. place and time captured through GPS and camera-timestamp, to automatically organize photos with respect to space and date (Chen et al. 2006). Content analysis was then introduced to complement metadata in clustering photos: colour analysis and time to detect a scene and mark an event (Platt et al. 2003, Cooper et al. 2005); content analysis and GPS information to automatically identify relevant buildings (O'Hare et al. 2005); and face recognition to organize personal photos into albums (Zhang et al. 2005). This trend of enriching metadata has expanded to include other contextual information such as weather conditions (Naaman 2004), movement detection (to detect walking or standing via accelerometer data in a SenseCam (Qui et al. 2011)), tags and social use (Sawant et al. 2011). All these techniques performed well in lab evaluations, but studies in the home show that people do not use photo systems to organize their collections and often fail when retrieving (Whittaker et al. 2010). While one might argue that it is just a matter of time before photo management software is widely adopted, evidence show that advanced features (such as content analysis and speech annotation (Rodden and Wood 2003)) are not used and not generally found to be useful.

Besides technology-focused research, managing photos has also been explored in terms of workflow. An early analysis showed several workflow phases: capturing and editing on camera; downloading onto a PC, editing and backup; preparing for printing or sharing (Kirk et al. 2006). Further studies showed how many people and multiple devices are part of a complex ecosystem of home photography (Neustaedter and Federovskaya 2009). A distinction between management of the digital and the physical emerged in several studies that identify tensions between house members who find themselves unable to retrieve valued photos that have been organised by others (Neustaedter and Federovskaya 2009, Durrant et al. 2009).

However the design of new photo systems overlooks the fundamental fact that people do not actively organize and maintain their collections (Frohlich et al. 2002, Whittaker et al. 2010). This is not a new phenomenon introduced by digitisation, but a general attitude to visual mementos: most of the time printed photos are kept loose in boxes and used as a support for conversation (Frohlich et al. 2002, Crabtree et al. 2004). While the above systems include complex features supporting targeted search

such as finding a picture or a small subset of relevant photos within a large collection, field studies consistently report little evidence of these search behaviours (Frohlich et al. 2002, Kirk et al. 2006). Instead, the distant past is revisited out of serendipity or happenstance and effective photo systems should take this into account: 'the most successful photoware [offers] the greatest affordance for image-based communication. For example, loose photographic prints can be recruited quickly and flexibly into face-to-face conversations []. They enhance already existing channels of informal communication' (Frohlich et al. 2002). In addition techniques such as content analysis may fail to capture what is truly significant to users: important photos are actively selected using highly subjective criteria (Frohlich et al. 2002, Petrelli et al., 2008). As we discuss below, these personal criteria are often symbolic and idiosyncratic, and therefore unlikely to be found by content analysis software. However these advancements in automatic processing might be effectively used in other ways, e.g. to support collection browsing starting from the important photos on display, as discussed in Sections 5 and 6.

2.2 Photos in a social context: reminiscing and sharing practices

The social dimension of photos has been a common topic of research in sociology and material culture. The emergence of digital photography and its ubiquity in people's lives following the emergence of camera phones has also attracted huge interest from HCI researchers.

Early studies looked at existing practices with printed photos in the home to identify principles for digital photo technology dedicated to *sharing*. This was generally limited to a few carefully selected photos sent via email to friends and family (Frohlich et al. 2002). The transition from print to digital provoked a generational shift in curator, from the mother being in charge of the printed collection to the teenage children who control the digital technology (Durrant et al. 2009). This generational change is reflected in a shift towards using digital tools for photo editing and online sharing (Durrant et al. 2009). However sharing family photos through photo websites (e.g. Flickr, ImageShack, Photobucket) does not seem to be common: findings across different studies consistently show limited sharing of personal photos; when these do occur they are limited to highly controlled groups due to concerns about privacy (Whittaker et al. 2010, Sarvas and Frohlich 2011). Interestingly, the ease of sending photos to others has not made offline social sharing of photos obsolete. On the contrary, the emergence of the web has expanded the co-located sharing of albums and displays to include slide shows on desktops or, more commonly, on laptop computers (Van House 2009). Moreover the ubiquitous offline sharing of pictures on mobile phones has emerged as new practice (Van House 2009). Therefore the design of compelling technology for digital offline sharing at home, remains a critical practice that demands support.

New technologies such as interactive surfaces are promising as a way to support sharing (Terrenghi et al., 2007). Tabletop computers allows a group of people to view, organize, and retrieve photos (Shen et al. 2003). More sophisticated tabletop interactions have been proposed, such as using a physical dial to select (via tangible rotation) a subcollection of photos (Hilliges et al., 2007). However, tabletop technology has not shown widespread user uptake. A field study of an interactive table for photo and archiving in three family homes did not elicit the expected extended use and enthusiasm (Kirk et al 2010). Instead it revealed tensions such as accommodating an imposing object (the tabletop was the size of a small cabinet) with a self-defined aesthetic into the different aesthetic of an existing home. In addition there were questions about what the tabletop symbolised. Was it an expression of technology - fitting the father, or of domesticity? - fitting the mother? There were also issues about who should use it: could the children play with it and should visitors be allowed to experiment? (Kirk et al., 2010)

Some alternatives to the table have been prototyped. (Hoven and Eggen 2008) and (Nunes et al. 2009) both proposed a system that uses the family TV set for social display: a digital photo album may be associated with souvenirs enriched with an RFID tag - sweeping the souvenir on the TV displays the associated set. Banks and Sellen's Shoebox (2009) is another example of tangible interaction: digital photos are stored in a wooden box, a touch sensitive face of the cube allows 'finger browsing' while another face is used for photo display. In both examples effort has been made to extract the photos from the digital domain of the PC into the physical space promoting social activity, thus addressing observations in earlier work that digital collections were seen as less visible than their physical counterparts (Petrelli et al., 2008, 2010).

Thus online sharing has not removed the importance of co-located sharing. In addition, the issues discovered in the deployment of the interactive tabletop reinforce our argument (discussed in Section 4.4) that the aesthetic of the home should be respected and that digital photo systems should be designed so they can be appropriated into their users' personal and social practices.

2.3 Types and arrangements of photos at home

Several studies of photos in the home have inspired both designs and design implications for new photo display devices. Swan and Taylor (2008) found that home photo displays represent family values beyond the photo content, arguing that there are opportunities for designing imaginative ways to display personal photos in the home. Drazin and Frohlich (2007) looked at home practices with printed photos and the way these support remembering 'as a socially active act which happens in interaction with the external, material world' (Drazin and Frohlich 2007). They identify various types of display including: disposable photos, 'disorganized masses of photos which lie around the home [] they are fragmented moments of memory'; the Rogues' Gallery, pictures 'displayed in an informal way such as stuck on a board'; albums, that 'materialize the chain of memory from a particular year [] a current of memory more than dislocated moments'; and framed photos that 'have been marked out as having a very visible personal value' (Drazin and Frohlich 2007). These different ways of using photos, they claim, show different intentions to remember. Moreover when a memory has been materialised it has to be arranged in space. This may create tensions, as the person in charge of curating the home is the one who decides which photos of what people are placed where, sometimes with little space for others to contribute or question the choice (Drazin and Frohlich 2007, Taylor et al. 2007). The curator of both printed photos and the aesthetic of the home is generally the mother (Drazin and Frohlich 2007, Kirk et al. 2010, Neustaedter and Fedorovskaya 2009, Durrant et al. 2009) and the shift to digital photos, curated by the father, can be a source of disempowerment and frustration (Petrelli and Whittaker 2010, Kirk et al. 2010).

Family tensions around photo display were also found in other studies that propose new designs (Taylor et al. 2007, Swan and Taylor 2008, Durrant et al. 2008). Obligations to display the photo of a relative in preparation of their visit shaped some design concepts for photo display (Taylor et al. 2007, Durrant et al. 2008). Other proposals focus on informal selection of digital photos from the household collection (a sphere to overview or zoom in the collection; a room-sensitive photo frame (Taylor et al. 2007); a photo cube that fetches new photos when shaken; a photo slider that projects a different picture on the paper prop posed in front of it - sliding the paper closer or further changes the display; a mosaic with changing photos (Swan and Taylor 2008).

A field study comparing attitudes across generations shows an interesting split in photo practices between parents and teenagers of the same family. The mothers curate and control the family archive and home display allowing only minimal interventions, if any; teenagers create (often by duplication from the family archive) their own physical display in their bedrooms or online posting (Durrant et al. 2009). However the goal of picture collections seems to be opposed in parents and children: parents use photos in the home for bonding within the family while teenagers' use is self-centred and outward looking (Durrant et al., 2009; Odom et al., 2010, 2012).

Only two other studies analyse the location of photos in the house as influencing display and meaning. Swan and Taylor (2008) list a number of properties they observed in different photo displays, with placement being one factor among others such as setup; persistence; form - size, colour, material, portability; Kim and Zimmerman (2006) observe how photos are displayed in homes and suggest that formal rooms host more professional, recent photos than informal rooms. They propose a design concept of a central system for storing photos and distributed displays around the house: specific photos selected in the repository are then sent into a specific frame.

Overall, a paradox seems to emerge. Although the home is a shared space, the strict mother-controlled display of photos can reduce the sense of ownership of the space, particularly for teenagers. Digital collections remove restrictions, democratising the ownership of family photos (Odom et al., 2010). But many mothers find technology a barrier to accessing the family collection and may need external help (often from their children), whereas albums and prints are easy to use and are always at hand. Home as a dictatorial or democratic space for photo display is an interesting challenge for design. In the design concepts proposed in Section 5 and the reflection in Section 6 we

explore possible interactions to lower the technical barriers and to accommodate space personalisation.

3. The Field Study

3.1. The Memory Tour

The fieldwork aimed to understand the principles of how and why an object becomes a memento. Participants led the house tour and, ultimately, the data collection. They were asked to show three different spaces they identified as public, family and private and in every space to select at least three significant objects and tell their story. To select three mementos in three spaces was the only condition imposed, and it was made clear that there was no restriction whatsoever on the type of objects people could choose. This 'memory tour' allowed us to collect both autobiographical narratives as well as observations about object location and accompanying emotions displayed by the informant, e.g. the way an object was caressed or held. While there were specific topics we intended participants to discuss (*what* the memento was about, *why* it was important, *where* it came from, *when* it was acquired, *how* it functioned as a memento) we did not pose any questions. Participants were invited to talk freely and prompted by the researcher only if those aspects were not spontaneously mentioned. The overall tone was informal and friendly, and a small gift was given as token of gratitude for their participation.

We asked participants to visit three different spaces and to select three objects in each. By contrasting three different room types we probed the relations between the public/private nature of the space and the type and intimacy of the mementos in that space. More precisely we intended to discover if there was a relation between the intimacy of the objects of memory and the room they were in: our expectation was that public rooms where visitors are entertained would have less personal objects than family rooms or personal spaces where more intimate objects would be located and personal reminiscing is more likely to occur. During the memory tour some informants claimed not to distinguish public and family rooms, while others clearly did. By observing the properties of rooms most participants classified as public, family and personal, we were able to extend the classification to all participants: *public* - formal rooms (sitting room, lounge) where acquaintances and visitors were entertained; *family* - informal places (family room, kitchen, dining-room) reserved for family, relatives and close friends; and *personal* - bedrooms or studies, accessed by all family members, but of particular significance to the informants. Personal spaces were often part of a shared room, e.g. a chest of drawers, a desk or even just the content of a drawer. However participants had a clear idea of what was their own and what was shared and selected objects accordingly.

The request to select three objects in each room might be seen as a source of potential bias. However, it was clear from participants' behaviours that certain objects were privileged. Most of the time participants did not scan each room deliberating, but went straight to certain (sometimes concealed) objects. This shows it was clear to them which objects were most evocative. In other cases participants discussed more than the nine objects we stipulated if other significant objects later came to mind. Moreover, some participants at an early stage of the tour foreshadowed important mementos they would discuss later. The richness of the narratives and the participant comments also supported the view that we had collected stories about people's critical autobiographical memories. All these observations point to the fact that informants had a clear idea of which memories and mementos were important to them. As a consequence we are confident the stories we have collected relate to important photos only.

Finally we were reliant on participants' accounts. We acknowledge that both the autobiographical narratives and the conversations around the objects were constructed by participants for the purpose of the study and therefore different from, for example, conversations within the family, or between family and visiting friends. However there were many indicators that participant narratives revealed genuine feelings about valued objects. Indeed during the tour we observed a wealth of non-verbal behaviours such as body language (e.g. how participants hold the photo); emotion (e.g. silences punctuating sombre thoughts); and the physical context (e.g. where the photo is stored or displayed). These did not seem to be generated for our benefit as analysts. Overall we were able to collect an emotionally rich data set that combines autobiographical narratives with the observation of autotopographies. Other methods such as in situ recording of home conversations may gather more spontaneous interaction. However these techniques have significant privacy implications and would

have prevented us from collecting the non-verbal data discussed above, thus substantially reducing the emotional aspect of our data set.

3.2. Participants and Data Collection

The study focused on families with young children as they are active collectors of mementos (Stevens et al. 2003, Whittaker et al., 2010). Such families also have multifaceted family memories: parents have memories of their own lives before meeting their partner; shared memories as a couple; and are generally highly active as curators of their children's 'future' memories. A middle class sample was recruited on the basis of (Csikszentmihalyi and Rochberg-Halton, 1981)'s finding that they are oriented to memories and relationships in contrast to other social groups who focus more on possessions. (Csikszentmihalyi and Rochberg-Halton, 1981) also found a clear age distinction: teenagers and young people are self-centred interested in "me, now", the middle-aged are more attentive to the network of family and friends, and the older generation is mainly concerned with passing on their experience. Recruiting a sample of middle-class, middle-aged parents reduces the generalizability of the results, but reinforces its validity within the boundaries of the study.

Participants were recruited by acquaintance and covered a range of professions (doctor, museum conservationist, high-level manager, architect, training consultant, publisher, marketing manager), a housewife (with a degree in psychology) and a few academics). In total, 17 people (from 13 families) participated in the study, 6 men and 11 women; 5 were living in a country different from the one they were born in. When both adult family members participated, the tour was done individually. The partner was generally following the tour, sometimes commenting with surprise about the objects chosen. We did not have families do the memory tour together as we wanted to explore personal as well as family mementos and many of the materials chosen related to individual memories. At the end of the tour a short interview aiming at comparing digital vs. material belongings was conducted with both partners together. This engendered a three-way dialogue among the partners, and the researcher, leading to some questioning of each other's answers.

Each session lasted 90-120 minutes. It was audio recorded and pictures of the memento and its context were taken. In total, 187 objects and their related stories were collected. All the narratives were transcribed verbatim; the transcriptions were systematically analysed and relevant portions of text were classified and clustered by affinity. The dimensions used in the tour (what, where, when, why, who, and how) were used initially to broadly classify the snippets of stories. Further clusters by affinity were created within each dimension, e.g. the location of the object within a room was further split into: 'prominent' indicating a position that cannot be missed; 'on display' for items in view but that may be overlooked; 'concealed' for mementos that were hidden from view in a cupboard, a drawer, or a box. Finer clusters allowed us to analyse the data in depth and across multiple nuances. For example we were able to see which types of objects were more likely to be concealed, why they were important (e.g. representing relationships), and which time in the life of the owner they expressed. Data analysis was carried out using thematic qualitative methods, i.e. the analyst reads through transcripts of the narratives looking for common themes. In all cases, narrative transcript analysis was linked to rich contextual information, e.g. non-verbal data such as body language or paralinguistic expressions such as pauses or laughter. So a narrative about certain photos would be analysed in the context of the location of those photos, whether they were hidden or on display, and whether the participant had expressed non-verbal affect when talking about them.

3.3. Summary of Objects Chosen and Relation to Other Studies

The data set used for this paper encompasses items that were classified as photos in (Petrelli et al. 2008) but also instances of photos found in boxes (previously coded as memorabilia) and photos as artworks for a total set of 37 instances across 11 people as 6 participants did not select any photos, as discussed below.

The open-ended approach of the study did not impose any restrictions on the type of object chosen and therefore participants discussed a wider variety of objects than just photos. Indeed photos were not the most frequent type of memento accounting for only 16%, compared with 28% of artworks (both professional and amateur), 28% of mundane objects (such as a mug, a cookery book), 20% memorabilia (illustrated postcards, great-grandma's theatre binoculars), and 8% idiosyncratic objects (a dog collar tag, a shell collection). A detailed analysis of the different objects, their position in the home, their role in the person's life, is reported in Petrelli et al. (2008). The original

contribution of the current paper concerns the subset of photos selected as mementos, their spatial relation with other objects to form autotopographies, and their significance to the owner. In contrast to Petrelli et al. (2008) we offer a discussion based on an in-depth qualitative analysis of the instances of photos.

Few of our participants talked about digital photos in the memory tour. Only one person chose one digital object as a significant memento: digital maps of bike trips. The same person was also in the process of digitizing his image collection with both work and family photos, but having that collection digitised was important only for practical issues such as having thousands of images at his fingertips. The valued memento was the physical collection of images, possibly resulting from a past bad experience of hard drive failure. Despite this, all participants had digital objects that they considered important on a personal memory level. In the follow up interview, conducted after the memory tour, all participants mentioned digital photos: some had videos, sound, email, and digital art/craft. Despite their subjective importance they are very rarely revisited when they reside on digital devices (PCs, laptops, external hard drives, mobile phones, CD/DVDs) and they are seen more as chores to organize rather than as valued, evocative objects. We discuss elsewhere (Petrelli and Whittaker 2010) how digital belongings compare to material ones, e.g. email versus letters.

Some of the themes that emerge from the deep qualitative analysis of this paper resonate with and reinforce the statistical findings in (Petrelli et al. 2008) and some of the reflections in (Petrelli and Whittaker 2010). Petrelli and Whittaker (2010) compare physical and digital mementos and therefore touch on the physical/digital photo theme of this paper. In Petrelli and Whittaker (2010) we discuss issues of photo systems, such as how to manage, organize and retrieve photos in a domestic setting. Here in contrast we focus on the small set of affective photos that were selected (maybe from a large digital collection) as being of particular significance. Our focus on the *meaning* of these photos allows us to explore design concepts for technology that can facilitate meaning building as opposed to relieving users from management duties. We discuss the affective value of *photos* and how this can be captured and enriched via digital technology.

4. Findings

4.1 Photos as Mementos

This paper focuses on the role of photos as a special instance of significant mementos. Of the 17 participants, 6 did not select any photos. This does not mean that those 6 homes did not have photos on display, rather that informants consciously selected different, non-photographic objects in their memory tour. Other participants displayed quite the opposite behaviour selecting photos most of the time: *"the pictures¹ are associated more with an atmosphere, I think, and a time, that one can recall, so the pictures are not 'two dimensional' like they are on the page, they unlock a much bigger database don't they? Like smell."* and *"if I had to run out of my house on fire with one thing, it would be the photographs of my mum and grandma and kids, these would be it really."* These two comments indicate strong feelings about specific photos, a theme that emerged repeatedly: when photos were chosen as mementos they were highly significant.

One intuition might be that photo albums are the quintessential evocative memento, but they were seldom chosen for discussion. Although most participants had albums and mentioned them in passing during the tour (*"In here [pointing to a chest of drawers] we've got loads of photograph albums [] we have occasional bounce of energy where we put more photographs in", "I tend when [the pictures on display] start getting creased up I just sort of put them away in my albums because I like getting out an album and looking at all my family photographs", "I went down to London a couple of days ago to meet up with old school friends and so I got the [album] out to show what we looked like when we were sixteen"*), only one participant selected and talked about them as a significant memento: *"these are where all these photo albums are, now I am sure, in one of them there is some photos of us going to India [] which the children think are totally hilarious. When they are waiting to use the computer we all look at all these albums"*. One participant actually mentioned the photo albums located out of reach on the top of a shelf (*"the albums we've got on the shelf, I haven't looked at in ten years"*) showing that the

¹ Participants usually refer to photos as 'pictures', all quotes using the term 'pictures' refer to *photographs* and not other forms of visual art, e.g. drawings or paintings.

location is important and affords specific functions: photos around the house in easy reach do not function as items for immersive reminiscing. Photo albums seem to have a similar life as a digital photo collection: on special occasions such as when relatives are visiting or on Christmas day, a digital photo show is set up and enjoyed as a social event (Petrelli and Whittaker 2010). However for both physical and digital collections album access is sporadic.

The relation between significance and manner of display was complex: significant photos were not necessarily in full public view. Eight highly significant photos were actually hidden from sight: they had to be retrieved from wallets, boxes, deep within drawers, or from the back of wardrobes. Despite their physical inaccessibility they were nevertheless very salient to participants. Participant accounts also indicated that the value of the photos was not representational but symbolic: *"I think that's the point of objects. They contain memories, but they're not explicitly about the memories. As far as you're concerned, that's a photograph of a boy. For other people it may mean something completely different."* Personal memories are embodied in the memento that localizes the memory in time and space mediating between past and present, the self and the others (van Dijck 2007). Personal photos can, therefore, be considered at very different levels from what can be directly seen in them or what they seem to show. As will become clear, the meaning is beyond the simple representation of people and events and expresses family values and a sense of unity: *"Part of the value [of the photos on the wall] is that they're not mine, they're ours. I might judge more harshly and say 'let's get rid of that', but I can't"* (commenting on the photo wall in Fig.1).

As this excerpt shows, to the owner's eyes, photo mementos hold very deep and different values constructed through careful selection and continuous meaning building: layers of significance are added as time passes and more life events can be associated with the memento. In other words, every photo memento has a long and complicated story behind it that is richer than the literal representation of that person or situation.

"Part of the value [of the photos on the wall] is that they're not mine, they're ours. I might judge more harshly and say 'let's get rid of that', but I can't"



Fig. 1 A composition of photos in a 'photo wall' (repeated in Fig. 5b).

Photo mementos can also undergo a complicated history and provenance, leading them to represent far more than a single event or person: *"This collection of pictures was actually given [by us] to S's mum as a memento of that week [we shared together], and she died subsequently, but it is poignant partly because of S's mum but also because it is the only time before my father died that he came to France with us and met S's mum"* (commenting on Fig. 2). The collage in the photo frame promotes reminiscence of a happy week in France with friends and family, but at the same time commemorates deceased parents. This is done in a complicated and indirect way as two identical frames were given to respective parents with different photographs. Both frames are now in their home, one in the family room and one in their bedroom.



“This collection of pictures was actually given [by us] to S’s mum as a memento of that week, and she died subsequently, but it is poignant partly because of S’s mum but also because it is the only time before my father died that he came to France with us and met S’s mum”

Fig. 2 A composition of photos in a photo frame located on the mantelpiece in the family room (repeated in Fig. 5e). It was a present to the wife’s mother. A similar frame with different photos (given to the husband’s father) is in the couple’s bedroom.

This tangle of relationships and emotions is not unusual. In this excerpt a participant comments on photos of her father, reprinted by her mother and collected by her daughter: *“I have very few photos of my father and they are quite precious for me. My mother found them a few years ago and she reprinted them, because they were fading, yellowing. And then, C., my daughter, when she was in France spending a year there, went to see my mother and said ‘You know, these photos, granny, I’d like to copy them for mum.’ and that became a birthday present for me. So, I’m really fond of that.”*

Photos as presents seem to have a special additional value, inducing highly ambivalent reactions, as in the case of this participant, a designer, who cannot decide about the framing of his father’s photo because the framing expresses defining aspects of his mother’s personality (Fig. 3):



“This is my father, who died quite young, he died younger than I am now. It’s one of the few photographs I’ve got of him. My mother has cut this out very badly to put in this round frame, I’m a bit annoyed that she’s done that, but on the other hand she made this in a way, and she’s like that, this is exactly the sort of tacky decorative thing that she rather liked, she would constantly buy little plastic mouldings and stick them onto wardrobe doors and paint them gold, very nineteen fifties.”

Fig. 3 A photo selected during the memory tour: competing layers of significance surface in the comment.

The photo and its frame were actually in his mother’s home until she died. Quite naturally, the framing does not fit with the style of the room where it is currently on display nor with his taste, but he cannot see his way to changing it: while the photo reminds him of his father, the frame reminds him of his mother.

In summary, for their owner, photo mementos are not the same as normal photos. Photo mementos are layered with multiple, different meanings and they have articulated stories. They often represent connections among generations and are persistent over decades and sometimes over lifetimes. Photos do not become mementos by chance, but they are deliberately chosen as distinct symbols of personal values or special affections.

4.2 Formats and Meanings

This section looks at organization and meaning together because *how* people organise their photos relates to the meanings they express. Categories of photo display and their role have been discussed in prior work. Drazin and Frohlich (2007) and Swan and Taylor (2008) investigate different types of photo display in the home. Both studies found formal and informal displays such as in albums, frames, or loose groupings; where each display evokes a different use. Drazin and Frohlich (2007) argue that the act of selecting and framing is an intention to remember and therefore a projection toward the future. For them photos in the home are a materialization of memory, the manifestation of the product of the work of a person that transforms a space into a collective medium (Drazin and

Frohlich, 2007). Swan and Taylor (2008) include in their analysis the materiality of the frames, or the lack of it. Our study confirms and extends the findings in both studies. We go a step further showing how types of photos, display location and function are interrelated. We also introduce another category of photos in the home, photos in memory boxes, reinforcing the view of photos as objects of memories held and combined with other mementos. Photos occurred in 4 main contexts: frame, displayed cluster, artwork, and memory box which we now describe.

Frames

Half of photo mementos were single or paired frames (Figs. 3 and 4). Photos of people may be a favourite portrait, *“that photograph of [my son] H, because I remember very clearly when it was taken, he had chocolate on his face, and it was one of the first smiley photographs of H”*. Alternatively they may engender a sense of the distant past: *“that’s my mother with her sisters at a wedding in the 1960s. [...] They were sort of working class people, and look how beautifully they dressed and how elegant they are compared to people today”*. A frame might also be chosen because it was unique or irreplaceable in nature, *“this is [my husband’s] grandmother with [our son] as a baby. It is the only photo we have, she died shortly after”*.



“that was [my younger daughter] just born and that’s [my older daughter] totally amazed. It’s ten years in between my two girls and from the moment F was born P adored her. They are incredibly close. So that’s a precious photo.”

Fig. 4 An example of framed photo selected during the memory tour.

These frames aren’t purely about a specific person or event, rather they represent a *value*. Swan and Taylor (2008) noted that some portraits encapsulate a special view or feeling (*“boys being boys”* Swan and Taylor 2008). We too found that portraits often stand for something else: *“it was 20 years ago, I was 22, 23. I was travelling in South East Asia and we went up a mountain with some Burmese rebels and we didn’t have enough water, and I nearly died”* or *“a photo of a fantastic holiday in Canada. This is a picture of the children on the ferry between Vancouver and Vancouver Island with their favourite toys”*. While the casual visitor might interpret those two photographs as portraits, for the owner those photos are *symbols*, they stand for something else. Rather than being representational, they are abstract, or idealistic. The meaning can be deep, as in the following case where photographs of the grandparents are a symbol of moral values: *“a photo of my grandparents’ engagement party. They had a very very good relationship. [...] Maybe only because I have divorced parents, but for me it is a real partnership”*. The grandparents’ engagement happened before the participant was born, so remembering the event is clearly not the reason for the photo to be important. Its significance derives from what it embodies, it is of value in light of what happened after the event, i.e. the grandparent’s union contrasted with the parents’. The photo is not representative but symbolic.

Displayed Clusters

A third of the photo mementos were not isolated photos or pairs, but grouped in clusters. These included framed photos displayed in a group; small photos assembled into a larger frame; those displayed informally on a mantelpiece or stuck on a wall; or crafted in a collage. Clusters of photos were all organized around a *theme*, generally relationships (Fig. 5). However the relationship represented varies from person to person: the family of origin; the children; the partner – a hobbyist photographer through her displayed shots; a couple’s youth in the 70s along with family and friends.

Like photo albums, clusters of photos have many photos that have been purposefully selected. Whereas a photo album functions as a *biography* (Drazin and Frohlich, 2007, Chalfen 1987), in contrast a display cluster serves as a *key theme* in life. Display clusters also solve another different function from albums by shaping and enriching the everyday living space. The form they take has an aesthetic value and helps define the style of a room: for example Fig. 5b and Fig. 5d display unframed or paper-framed photos that combine with children’s drawings, toys and other memorabilia (cuddly monkey in Fig. 5b). They therefore convey a sense of informal, lively mess; at the opposite end of the spectrum the display of silver frames in Fig. 5a or the combination of stylish frames and decorative

objects in Fig. 5c give a sense of a controlled space, of formal intimacy. Clusters serve to create affect in everyday surroundings. In contrast, albums support absorbed reminiscing *“I just sort of put [photos] away in my albums because I like getting out an album and looking at all my family photographs”*. Less frequently they promote nomadic sharing *“I went down to London a couple of days ago to meet up with old school friends: so I got the photographs out to show what we looked like when we were sixteen”*.



Fig. 5a "Loads of pictures, mainly of my family in Germany, That's me when I was small: I must have been about 7 months or so. My mother and stepfather. My mother with [my son] few years back; my paternal grandfather; my father and stepfather. That's at our wedding [...] M's mother and that's his father ..."



Fig. 5b "This is like our family history up here, so there's loads of pictures. All of those are I's three best friends. That's K that did the painting [a memento selected before], and there's [my son] painting when he was tiny, our very first holiday in the camper van, so these are all people we met there and we are still in touch. [...] But I could go on forever."



Fig. 5c "Photos of my two daughters are really really essential to me. I'm divorced and it's very much the three of us. [...] Quite a few of them are important because they were taken in Scotland. I love that wilderness; we were outside in the thyme, walking, playing. I just have wonderful memories of this."



Fig. 5d "Seeing [the children] evolve and in a way, having pictures of when they were very little, reminding me how cute they were [laughs], because the everyday struggle of getting them to do what you want them to do is very very hard, and you can get very upset with them, but when you look at their faces like that, it sort of brings back the cuteness, and you realise, yes, I actually do really love them."



Fig. 5e "It's in France, it was a week when my father was visiting, it was the only time he met any of S's family. We drove a long way to get to this south west corner of France from S's place with her friend who is pictured here, that's her mum, and her younger sister."



Fig. 5f [while pointing at the different photos] "Memories of holidays. Me and C, so that's when we used to do these things, photos of Amsterdam and, Israel. Look! I've got hair! They're mostly Amsterdam and Israel, aren't they? That's Maastricht, the market place I remember how nice that cheese was, beautiful cheese"

Fig. 5 Examples of clusters of photos.

Artistic Photos

Four photos chosen as mementos were artworks: *“a series of photographs that were part of a photographic exhibition at [...] the place that I used to work. I really like them because they’re all done with a pinhole camera, so they’re quite unusual.”*, *“a picture of a cobweb [...] its by a friend who’s an artist [...] she does a lot of stuff with dust and dirt”*.

However, as with framed photos that are symbols of experiences or values, artistic photos are not purely aesthetic: (talking about the artistic photo of a cobweb) *“when I had my son I was in intensive care for three days and [my friend] came to the hospital and she went ‘oh I’ve just brought something for you’ and I opened it and I just burst into tears because instead of buying something for the baby, like everyone, she brought that for me.”* The photo therefore expressed not only a life-changing event (the birth) but also the importance of their interpersonal relationship. Personal interest and moral values motivate the pinhole photos: *“I’ve got an interest in that kind of photography, but they’re also a political theme: they show a sort of inability of the British to respond to the Irish famine; it’s a failed attempt to bring relief [...] this is actually the project for a road which was never completed.”*

Thus it seems that these artworks serve multiple functions. They are aesthetic objects that are ‘on display’ in public places increasing the attractiveness of those rooms, but at the same time they also capture and express important messages about relationships and self-identity. Finally, as attractive objects ‘on display’ they also promote and provoke conversation: because they are not representational in the way that photos of events and people are, they allow the owner to choose how they wish to talk about them, deciding whether or not to reveal their deeper personal meanings.

Memory Boxes

A few photos were parts of ‘hidden’ collections of heterogeneous objects that provided an infrequent, but highly emotive immersive experience of a period of one’s past. Containers, boxes and caskets are often used to hold collections of mementos related to a specific event, a theme or a specific time: a wedding (‘hope’) chest, surviving objects spanning four generations (Fig. 6), the owner’s childhood, the child’s first year. Photos are stored with memory box items because they belong with a particular set of autobiographical memories: *“old family photos [among] old family treasure”* (Fig. 6), *“a locket with the photos of my mum and dad from when I was a child [in the childhood memorabilia box]”*. Here the photo is not public or ‘on display’, instead it is intended to trigger or participate in highly personal immersive experiences for the owner or immediate family. Photos in memory boxes contribute to heterogeneous collections but they are not the majority of the objects in a memory box (Fig. 6).



“This was given to me by my mother, last Christmas. She picked up all sorts of lovely little family treasures: pictures of my great grandparents, my great grandmother’s sewing things, my great uncles wooden carvings and all sorts of old family things. It’s like a little corner of part of my life.”

Fig. 6. An example of memory box; it contains just a few photographs, along with other memorabilia.

In summary, photo mementos can be found in many different formats: a single frame; a cluster of photos composed and edited to various degrees; artistic photos and intermingled with memorabilia in memory boxes. Apart from memory boxes that are intended to be hidden away, whatever the final arrangement, photo mementos display the attention devoted by the owner. They are well looked after, composed and framed. Even when they are not apparently organised as in the case of casual kitchen collections, their clutter is intended to evoke a feeling. The curatorial attention becomes an integral part of the value of the image and cannot be easily ignored or discarded because it expresses the personality of the curator.

4.3 Space, Place and Access

The *context* of the photo is also essential to understand its function in the person's life. To do this we looked at precisely *where* each type of photo (frame, displayed cluster, artwork, memory box) was placed. In line with the autotopography framework, we expected participants to make careful decisions about where objects get placed. Different spaces in the house are used for different functions and by different people. It follows that where a photo is placed, changes its affordances for both social and individual interaction: *"Paper photos stuck on the wall here are very significant (Fig. 3b). Paper photos stuck in a box in the attic are less useful than digital photos. I haven't got the time in my life to go and get the box and look at them. The albums we've got on the shelf I haven't looked at in ten years."* Indeed the choice of room and position is never accidental but the motivation for a certain photo memento to occupy a certain place is deeply personal: [about the pinhole photos that were displayed in a public room] *"I'm quite interested, sort of theoretically, in projects that fail. But there's also a sort of bitter, irony: these projects for the potato famine, an absolute disastrous moment in Irish history, there's a kind of bitter irony that is in our dining room."* The consciousness of "bitter irony" of this display characterise the combination of the photos and the dining room as an autotopography. It represents a number of personal values, e.g. artistic interest, political inclination, a cynical view on life, living in Ireland not far from where the photos were taken and a previous job when the photo was bought. As such this display can be used to trigger many different conversations depending on what the owner tells to whom.

In *family spaces*, people tend to place photo mementos that refer to the nuclear or extended family. These photos spark intimate conversations between parents and children and reinforce messages about family relations when photos move from being in the background to become a focus of attention and conversation. One father said: *"There's a picture of [my partner's] mum over there [on the chest of drawers in the family room], that's there every single day, ninety nine days out of a hundred, no one will say anything, but one day the kids will stop and say 'So, how old was your mum in that picture?' or this, or that, and that one conversation out of however many totally justifies the picture being there."* The photo's location in the shared family space promotes such occasional opportunistic interaction and facilitates the shift from being a form of decoration to an object of conversation: *"pictures have a problem - you get so used [to them] that they're just sort of wallpaper, but then ... like yesterday [my daughter] C picked every one out like 'who's this? And who's that?' and I explained all about my relatives in Germany. See, [my children] don't see their grandparents an awful lot, talking through pictures they remember them"* commenting on the photos in Fig. 3a.

Understanding how displayed photos integrate into the fabric of the home is critical. Photos are treated like any other memento, they have the same properties as other objects when it comes to autobiographical memories: *"I don't have the kind of big collection of family photos out, but I have other kind of memories that remind me of my family"*. So in a sense it should not surprise us to find photos combined with other objects in sort of personal spaces, i.e. a composed autotopography (Fig. 7).



"Well actually all the furniture is my own corner because that came from my aunt and was made by her husband. This chair comes from her godmother, and again was given to me when her godmother died because I'm the godchild. [the chest of drawers] was in my bedroom, so really all the furniture is related to my memories, very very strongly, and the photographs as well – this is my family: this is my father when he was a baby, and this is my grandmother. These two are [photo-]postcards which were sent to the Italian family, my grandfather, Italian grandmother, my sister and myself."

Fig. 7. An example of autotopography: objects and photos represent the person's history and identity.

Participants were aware that they were engaging in a conscious design process: [talking about the photo wall Fig. 3b] *"These photos are in the grain of the room, they're not just there because they can be. Sticking [a photo] on [the wall] is consuming it, I often point that out to people 'this is so-and-so' and this*

is our kind of reference point". Others might do so implicitly. The result however is a coherent mixture of objects and photos that integrate history and identity into an inhabited living space.

To better understand the relation between realisation and location, all photo mementos (as with all the other objects (Petrelli et al. 2008)) were classified with respect to the *type* of room they were in, i.e. whether they were in a public, family or personal location. Photo mementos are not equally distributed around the house, but they tend to be placed in personal and family spaces. Moreover certain types of photo are more frequent in certain spaces. Art photos are for social use (none was in a private space) while clusters of photos occur more in family and intimate spaces. This supports the view that art photos are intended for public display, being attractive or provocative in social spaces where strangers or friends might be entertained, but serving to promote controlled conversation because they aren't directly revelatory. Clusters of photos representing themes tend to be situated where the family can see them. They are for more private viewing, or the type of deep conversation about family history and values we described earlier.

We also looked at the *manner* in which photo mementos were displayed within the room: prominently (i.e. where they cannot be missed), on display (i.e. visible), or hidden from view. Interestingly photo mementos are more likely to be prominent in the family space than anywhere else, presumably as a way to affirm affective bonds. Display in public rooms is more subtle, with photos on display but not necessarily 'there to be seen'. The prominent position in the family space could indicate a form of continuous relationship building in a space that is in daily use. Photos give out a clear message about family values and unity, supporting parent-child communication about distant relatives. Finally photos in private areas seem to be for personal use. They are much less likely to be part of an obviously designed aesthetic space: in contrast, they are intended for deliberate immersion or accidental discovery rather than frequent viewing or conversation. In one case such concealment was a deliberate attempt to forget: "*Well, anything to do with my marriage [has been thrown away]. No, there's no photos. But I've kept one photo, because it's one I couldn't throw of my wedding day, which is really odd. I threw everything, every single photo, but not that one, I'm sure, you know, I kept it for myself: [my daughters] would be very very surprised to see it.*" Photos like this that are for an exclusively individual use are, however, rare: the only other case was the portrait of a suicidal brother that one participant kept privately to himself in his wallet.

Finally, we looked at *when* photo mementos were chosen from the participant's life, and how this related to location. Contrary to what might be expected, more than two-thirds of photo mementos were of *recent* years or of adulthood. A minority referred to whole lives and just a few photos were chosen from childhood, youth or the participant's roots, e.g. ancestors and relatives. The distribution of old and recent photos in the house is uneven: public areas contain exclusively recent mementos, and there are none from any other period of life. This contrasted with both family and public areas: in both these cases there were wide temporal spreads, but with adult photos being the most prevalent.

The type of room, the manner of display and the time in the person's life all seem related. The same person might have photos of the same people in different places in the house serving what seem to be different functions. Fig. 8 shows different comments from one participant, a scientist, about photos of the grandparents in her bedroom (Fig. 8a was described first in the tour) and in the family room (Fig. 8b).

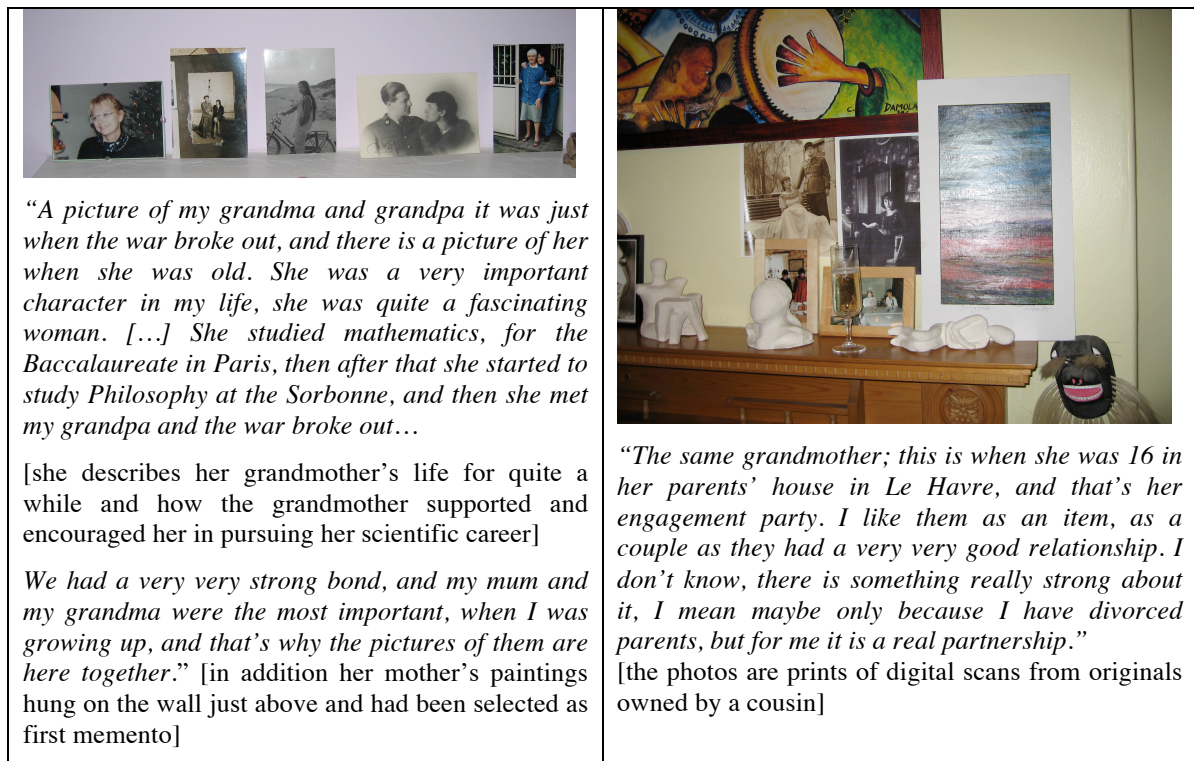


Fig. 8 Photos of the grandmother displayed on the mantelpiece in the bedroom (8a) next to other photos and objects belonging to her mother and on the mantelpiece in the family room (8b) next to little sculptures made by the participant and her partner at an art course.

The two sets of photos seem to provoke quite different thoughts. The one in the bedroom (Fig. 8a) engenders personal identity as she sees herself as similar to her grandmother with their shared scientific interests; they are also clustered with other objects that belonged to her mother, such as her mother’s paintings, creating an autotopography of influential role models.

The engagement photo, in the family room (Fig. 8b), seems to provoke more thoughts of partnership, domesticity and mutual support. It is on display next to a few little sculptures, selected as a memento by the partner, that were made by the couple on an art weekend together. Although the photo and the sculpture were discussed by two different people, they are located in physical proximity both as symbols of solid partnership.

Interestingly, choosing multiple expressions of the same relation is not unique. One participant commented on several photos of his wife on the family wall (Fig. 5b) but when in his private study picked another one: “that photo there is [my partner] when I first met her, a Polaroid photo taken in my flat, and I put it in that frame, and I used to take it with me travelling.” The photos of their current family life are on the photo wall in the family room; the symbol of their partnership taken 20 years ago is in his personal study. The divorced mother has several frames of herself and her daughters on display in the public room (Fig. 5c) and a single framed photo in her bedroom on the bedside table (Fig. 4) of the two daughters when the younger was a baby, a more private space for a more intimate and older photo. It contrasts with those portraying herself and the grown up daughters on display in the public room (Fig. 5c) and captures a different level of intimacy.

In summary, photo mementos are deliberately located in different places. The more evocative the photos the less likely they are to be on public display. The place of display (or non display) affords different access and use: photos that are constantly on display trigger conversations and can suddenly come into focus from a merely decorative state. Public spaces generally display photos that can be easily commented upon with strangers and have an aesthetic value besides their content. Photos in family spaces are essential to constructing a sense of identity and to reinforce family relations. Photos in personal spaces are less formal and sometimes poignant. Often photo mementos are arranged together with other objects related to the same affective theme, e.g. a person, an event, to create autobiographical landscapes.

4.4 Design Considerations and Challenges: The Aesthetic of the Home

At the end of the memory tour we questioned participants about their digital mementos (Petrelli and Whittaker 2010) and on possible technological intervention in the home for easy access. The conversation revolved mainly around photo display and photo access, because digital photo frames are a known technology. One of the issues with introducing new technology in the home is a potential clash of styles. Photographs on display obviously contribute to the house aesthetic and every house has its own style, as illustrated by the six images in Fig. 5. Photo mementos relate to, and fit with, other (usually non-photo) objects composing a mixed-media background for family and personal life. When imagining new digital technology designers have to keep in mind that photos are an integral part of the social space of the family home, combined and integrated with other objects. This observation seems to argue against the idea of a dedicated display point. Technologies such as digital photo frames or various types of tabletop have been touted as having properties that might facilitate phototalk (Kirk et al., 2010), but they seem to clash with the feelings people have about their home: *“digital images would make a lot more sense in a digital kind of environment”*. Another important issue is the control people want over their environment, *“I want to frame [the images I really want] and have them there, but something changing, no, in a way you choose something and that’s the one thing you really cherish”*. Digital tabletops do not seem appealing both because they are too intrusive and not integrated into the fabric of the home: *“There’s a problem: you end up with something like a TV that has a particular status, whereas the objects in the room are more in the grain of the space.”*

These comments illustrate how designing digital technology for the home is challenging. It is a very different context from the office. The home has its own moral order defined by the people living in it that can change over time and circumstances (Strain 2003). At home people cultivate their identity, they can be themselves, sheltered from the effort of keeping their status in society, by imposed formalities and by the pressure of work duties (McCracken 2005). Different rooms have different affordances for individual and social activities and the position of digital technology in the home can facilitate or hamper use, e.g., a PC in the basement, far from where the domestic life occurs, requires an intentional effort compared with the use of a PC in a family room (Frohlich and Kraut 2003). All these observations contribute to shape the domestic space as a special environment. Digital technology needs to be strategically designed for use in the social context of the home.

New technology for the home should not stand out as alien, other; it needs to blend with the background, with everyday life, with other mundane objects and activities: *“something where I don’t require a computer, that allows me to visualise, personally, or to share with a friend, like a photo album”*, *“like to pick up a book and display”*, *“something that is portable”*, *“different from everyday life”*. As such the challenge in designing digital technology for photo mementos in the home is exacerbated by the need to propose devices that support appropriation, to blend in with the environment and support the different formats and activities we have identified in our study.

5. Conceptual Designs for Digital Photo Mementos

5.1 Design Process and Rationale

Our study showed four distinct functions are served by different realisations: photos in frames are often symbolic and express values, clusters contain themes or life highlights, artworks are intended to be attractive but to engender interaction, and finally memory boxes are an occasional, re-discovered, immersive experience. As a whole our findings emphasise the symbolic value of photos and the importance of narrative and culture above the factual retrieval as mnemonic aid. This is in line with the most recent research in neurobiology and cognitive psychology that suggest a model of human memory different from the store-retrieve archive model (Brockmeier 2010). This presents a complex design challenge as we move away from retrieval systems and towards technology that is centred on personal value and emphasises creative reminiscing. More than a single technology (e.g. digital tabletops) to support the multiple, heterogeneous uses we have seen, photo technology in the home should be designed to distinguish the different functions afforded by the room and layout. In addition, designing for the home must take into account the materiality and the aesthetics of the domestic environment and the lives people live within it.

To explore how this design challenge might be answered, the second author designed several conceptual digital devices and systems. The design work was informed by the field study findings discussed above and relevant themes from the related work.

The aim of the conceptual design work was not to literally translate the findings into functions in digital devices, rather to use designing to further develop the findings' themes and map a space for future design. Here, we propose how digital photos might be used in the home in similar ways to printed photos whilst also suggesting new interactions, afforded by technology, that respect and build on the human values expressed in current practices. Such research through practice (Archer, 1995; Frayling, 1994) produces a complementary form of knowledge to the field study findings in that it is *generative* – it focuses on understanding what *might be* rather than what *is* (Gaver, 2012). The designs produced are not purely speculative; they are the designer's attempt to frame and solve problems relevant to the complex situation described above. Here, design is an enquiring process of thinking through making (Gedenryd, 1998). The concepts discussed below then do not present a complete solution to the design challenge outlined, rather they are examples of *what* could be designed to inform and inspire others' practice and begin to map a relevant space to explore (Binder and Redström, 2006; Gaver, 2012). As points in this space, the concepts act as provocations as well as potential solutions (Bowen, 2009), highlighting alternative functions or roles for further consideration (e.g. 5.4).

5.2. Themes Explored in the Concepts

We found particular field study themes directly useful as departure points for design: the potential of *frames, clusters* and *memory boxes* (4.2), and the implications of the *aesthetics of the home* (4.4). Seeking inspiration for design from the field study as a whole also framed new themes: *space, place* and *access* (4.3) and the *aesthetics of the home* (4.4) illustrate how photo displays move from *background to foreground* and highlight a need to ensure that the functionality and content of display devices is *personalisable or appropriateable*. Several narratives also demonstrated the value participants placed on *making*. The choice of a photo to frame (and the frame itself) is a creative act but it is also an act of *curatorship* – selecting 'special' images to frame or put into albums (while others are left in boxes in the attic). The placement of framed photos, next to other meaningful objects within the home and as collections of related mementos, is also part of this curation of memories and something that digital devices could enable.

These themes and features are explored in the following concepts summarised in Table 1. In describing each concept, we further reflect on how it relates to the field study findings. Other researchers such as Taylor et al. (2008), Banks and Sellen (2009) and O'Hara et al (2012) have proposed how new photo display devices might be enriched with new functionalities that support personal reflection and interaction. These partially overlap with some of our proposals, such as inviting interaction through fading away (5.4) or projecting on the wall for social sharing (5.3).

	MemoryBook	ProjectoFrame	NeverFadeAway	PicGrabber, DigiPrint
Frames			✓	
Clusters		✓		
Memory boxes	✓			
Aesthetics of the home	✓		✓	✓
Background to foreground	✓	✓	✓	
Personalisable or appropriateable		✓		✓
Making/curating		✓	✓	✓

Table 1. The table shows the connections between the outcome of the study (expressed as themes and features) and each design concept (MemoryBook, ProjectoFrame, NeverFadeAway, PicGrabber/DigiPrint).

5.3. The MemoryBook

A novel finding of our study is that photos in memory boxes contribute to 'a complex network of memories and meanings' (Holland 2004) and, in contradistinction to photos on display, they are for special, limited and very personal access. Photos in this context form part of an evocative set of

heterogeneous objects that are visited occasionally for immersive personal experiences. A similar mix of personal photos and personal objects can be reproduced in the digital world. Digital technology can supplement these objects by automatically harvesting related digital materials from personal and public repositories. Related personal materials could include emails or Facebook posts from friends you have access to, and public materials might be fragments of news or popular culture associated with a specific time accessed from websites. These would allow us to create and sustain a network of connections between existing physical and photo mementos and these other associated materials.

MemoryBook is a place to store digital keepsakes together with small material mementos. The content of the MemoryBook is to be revisited in the future rather than on permanent display: it might consist of an email after a first date, congratulatory comments on a baby's birth announcement on Facebook, or a video clip of a special family meal. The device might sit unobtrusively on a bookshelf and, when opened, reveal a touch screen on the left and a container on the right to hold related digital and material memorabilia in the same place. But MemoryBook cannot be opened at any time, instead you must wait for it to open. It signals this by occasionally softly glowing, perhaps on significant dates relating to the keepsakes within it. At these times, its multimedia digital content can be played on the MemoryBook's display and loudspeaker.

The concept of a mixed material-digital memory box is not new. Frohlich and Murphy (2000) experimented with an active Memory Box that would play stories recorded by the donor and associated with objects when those objects are taken out of the box. Stevens et al. (2003) used the concept of a box as a metaphor, a container for digital copies of family memorabilia and their stories. The MemoryBook differs from these in several ways. The Memory Box (Frohlich and Murphy 2000) only associated deliberately recorded sounds with objects, while the MemoryBook extends the type of media to any digital media content the person considers interesting to preserve for the future. It also takes advantage of automatic content harvesting and connection making, in addition to explicit (human) selection.

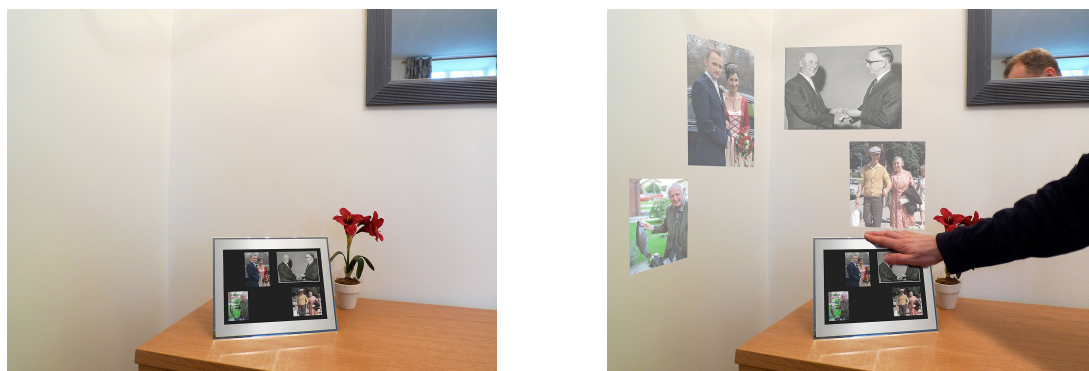
The Living Memory Box (Stevens et al. 2003) is intended as a family archive of deliberately generated content. Conversely, we see the value of the MemoryBook as a catalyst for already existing multimedia content that is scattered across other contexts (e.g. email and Facebook pages, daily news or popular TV programs). The digital fragments are related and therefore acquire a higher value when assembled in a single place for future use.





5.4. The ProjectoFrame

Consistent with the autotopographical perspective (Gonzalez 1995), our findings show the importance of a photo's location: different types of photos in different locations are clearly serving different functions. Older, personal photos are placed in more private spaces for individual reflection, while recent and more aesthetic ones (artwork and family photos) are in social areas where they can spark conversation with guests or family members. Photo mementos afford and facilitate behaviours not commonly seen with other forms of photo artefacts. Most of the time they exist as background, as part of the room layout but they can suddenly come to the foreground to become a topic of conversation. Family photos in particular are arranged to be highly salient to elicit opportunistic conversations with children about family history and values.






The ProjectoFrame allows a family to compose a small group of related photographs, perhaps new parents want to share images of distant family members or collate images from a memorable holiday. When activated by touch (using a heat sensor) the frame projects the images onto nearby walls for a short period. This brings these background images to the foreground affording conversation and sharing. In the examples above, Mum might familiarise baby with her relatives, or Dad might use it during a dinner party discussion of recommended places to visit. The screen might be touch sensitive and each photo connects with a set: by selecting one of the photos the slide shows starts supporting further conversations triggered by the initial image.

Novel ways of displaying digital photos have been proposed by Swan and Taylor (2008) and Taylor et al. (2008). These include single or paired frames, cubes and spheres for multiple display and slides. In contrast to those concepts, the ProjectoFrame does not stop at the display of digital photos, but attempts to make the photos part of the room. Through projection it makes the photos a central point promoting shared conversation when triggered, while suitable for individual view when quiescent. It also affords a simple slideshow of explicitly selected important photos to be at hand for display allowing novel aspects of projecting photo albums in space.

5.5. The NeverFadeAway Frame

Photos on display in the home contribute to constructing personal identity: "photos serve the purpose of preserving the memory of personal ties" (Csikszentmihalyi and Rochberg-Halton 1981). Mixed with other mementos, scattered around the house, photos materialize connections between personal space

(the house) and time (personal memory): photo mementos are like ‘compressed time in space’ (Bachelard 1964). They anchor the memory to the domestic space and facilitate the purpose of communicating it to others (Bachelard 1964). Our study uncovered rich ways in which participants choose photo mementos, and how they integrate these into the fabric of their living space to provide reminders of, and access to, different aspects of their past and identity.

		
<p>What if photographs could reflect how important they are to you? A collection of digital photographs in NeverFadeAway frames can do just that.</p>	<p>If one photograph hasn’t been looked at for a while, it starts to fade and become sepia with “age”. Some images might be left to disappear (e.g. that jokey photo of Dad dressed as Santa from last Christmas), but others might draw your attention.</p>	<p>Picking up a frame restores faded images to their former quality (the device registers movement using a tilt switch). So, for example, the photograph of a long-gone treasured family pet is revitalized, along with the personal memory.</p>

Because photo mementos have been deliberately selected for display, they are usually emotionally loaded. But not all displayed photographs have emotional value, as the previous Doctor Who example demonstrates (Photos as Mementos). Often only those familiar with a particular image know its value. NeverFadeAway is a playful exploration of what might happen if this value was more obvious and draws the user’s attention to participants’ (possibly unwitting) curation of their memories. Fading images have been handled infrequently, so are they valued less by their owners? A fading image may prompt someone to interact with the frame and, in doing so, to reinforce a connection with its content. NeverFadeAway frames pose another question about value: is it something for public display or private use? Do we want this value to be shared with others or retained as a purely personal connection? Consequently the user would need to give more consideration to each photograph’s value and its placement in the shared space of the family home (Space, Place and Access).

5.6. PicGrabber and DigiPrint

The clusters of photos in Fig. 5 show a variety of styles and different way of using the images. Much effort goes into selecting the most meaningful pictures, framing and composing them. Mementos are carefully chosen and designed to fit with the fabric and aesthetic of the family home: technology must support people who want to be creative. It must be configurable and personalisable in ways that current applications (for editing and manipulation) or display devices are not. Instead technologies must support the appropriation processes that we saw at work when people carefully composed and curated clusters of photos and memory boxes. While new software for editing and configuring images are constantly proposed, one can imagine a substantially different interaction based on tangibility that transforms the act of curating digital photos into physical actions. Below we propose two elements of such a system: PicGrabber and DigiPrint.



PicGrabber uses contactless technology to transfer digital content between devices wirelessly. This small device works much like an eye-dropper or pipette – squeeze the device to “empty” it then place near to an image on one device and release the buttons to “suck” the image into it, then move to another device and squeeze the buttons to “squirt” the image onto it, for example copying an image

from a laptop computer or a digital camera to a frame containing a DigiPrint unit, described next.

Digital display and storage technology continue to develop. We can reasonably expect electronic-paper for persistent display to become available in the near future: storage and associated electronics could fit into a thin package the size of the displayed image. At this point the consumer need not to put up with whatever aesthetics digital photo frame manufacturers dictate but could instead purchase DigiPrint units that slot into existing analogue frames – thus providing much more scope for personal expression. Different units could also offer different functions to manipulate the image in different ways, e.g. morphing, pixelating or ageing.



PicGrabber and DigiPrint would enable users to create and manipulate clusters of photographs using tangible interaction metaphors more amenable to shared, social activities (such as the curation of mementos) than computer-based tools. Several DigiPrints can be displayed in a cluster with different frames and sizes. A family could walk around the house together, choosing images to “squeeze and squirt” into particular frames.

By reducing a digital display to the size of a mounted paper-based photograph, value and aesthetics can be imparted by the user in their choice of frame (Formats and Meanings, Aesthetics of the Home). So, the image of a beloved ancestor can be placed in a frame that demonstrates their personality, for example.

6. Discussion: Implications for the Design of Digital Photo Mementos

The previous section has demonstrated how our findings could influence the design of innovative devices and new interaction styles for photo mementos. The process of generating design concepts and reflecting on them has allowed us to expand our understanding of the meaning of photos in the home. In particular our effort has been directed towards proposals that are technically feasible and anthropologically sensible, concepts that have the potential to create a new relationship with known objects (Susani 1994) such as photos, frames and boxes.

We now build upon both the field study and design work to outline new principles for the integration of digital photo mementos in the home in a way that makes use of this real, deep and rich place to open up new possibilities for digital interaction (Susani 1994). The materiality of the home becomes the foundation for novel sociotechnical photo systems centred on the social aspect of photos *in* the home as opposed to the technology of photo systems used *at* home. This change of perspective, from technical to social, is important as it brings a different set of values against which the technological intervention should be measured. We now enumerate these new values.

Presence not Use: The standard way of evaluating technology effectiveness is through high frequency of use. However this does not hold for photo mementos that are emotionally intense but seldom accessed. Although designing to attract attention is an option, as in the NeverFadeAway frame, it is important that this behaviour respects infrequent use in the very specific context of the home. This is consistent with the goals of ‘slow technology’, purposefully designed for reflection and mental rest, “for *presence* instead of *use*” (Hallnäs and Redström 2000). So a photo system in the home is not for the effective retrieval of photos from one’s collection, but to create a presence that can suddenly become an occasion for conversation and storytelling.

Exploration not maintenance: The ProjectoFrame is an example of the integration of physical and digital; it gives physical location to digital content. One can easily imagine this frame becoming an entry point in the family collection allowing each member to have their own distinct set of photos (Durrant et al. 2009) to be displayed on the wall whenever they are wanted. Each displayed photo points to a digital album to be finger-browsed and augmented by the automatic retrieval of related images, i.e. same time frame or same people – as discussed in section 5.4 above. The sharing of digital photos currently needs human intervention to pre-select the images and set up the show (or burn the CD). However this is simplified by advances in automatic technology. The nature of a photo systems in the home then stop being exclusively for management, organization, and access; instead they can promote a more natural and serendipitous exploration of the collection by dynamically generating photo albums around themes based on current focus. We see as key how the digital complements, integrates and amplifies the material, in this case by supporting interaction.

Different devices for different uses: Our study showed that different photos are placed in different rooms depending on their affective or conversational power. Different rooms have different affordances for individual and social activities and the position of digital technology in the home can facilitate or hamper their use. The ‘sociopetal’ (bringing together) or ‘sociofugal’ (setting apart) function of the technology in the family home (Frohlich and Kraut 2003) can be purposefully used to design for sharing or “just for me”. This split is clear in two of the concepts we discuss: the ProjectoFrame acts as a sociopetal device that promotes conversation; the MemoryBox is a sociofugal device, designed for intimate immersion with sentimental objects. To recognize the value of specialized devices as opposed to general purpose ones is essential for the creation of intense and affective user experiences. Even if the touch photo display technology behind each is the same, the designed interaction is substantially different and supports the building of very different meanings, and fundamentally different styles of interaction.

Materializing digital belongings: Design focus should not be limited to supporting interaction: the choice of materials used in the making of a device can reflect the importance of the digital content and enrich our sensorial experience with it. Indeed Swan and Taylor (2008) point out the importance of the size and material of the frame in determining the affective value of the displayed photos. The design of technology for the home and for affective digital belongings must orient to both material and digital: affection and feelings can be triggered by casings, e.g. metal frames or wooden boxes, are as important as those triggered by flipping through an embedded photo album. This can be extended to incorporate the aesthetic of the room into the design, including the context of display and the objects nearby. The beauty of the container for personal digital belongings may trigger a positive emotion with its content even if it is rarely accessed.

Smart memory objects: One of our important findings is that photos are part of an *ecology* of personal memory objects; combined with other mementos to create autotopographies. Durrant et al. (2009) found mixed display of photos and objects in teenagers’ bedrooms. The same teenagers had a substantial web presence and see as a dream technology repositories containing multiple media (Durrant et al. 2009). Holistic design that seeks to combine the material and digital can address this: while the container, such as the MemoryBox, creates a single repository for material and digital objects, advanced retrieval systems could use the metadata from the digital mementos in the MemoryBox to harvest recent content or automatically make connections with other personal belongings. Smart objects and the Internet of Things will take this vision even further by supporting the complete integration of material and digital. The memory objects themselves will then have an Internet presence that will evolve over time. We can then imagine a framed photo connected to a Web of other smart mementos, possibly connecting different people that share the same memories, e.g. a family holiday or celebration.

7. Conclusions

In this paper we have looked at photos as tokens of affection and connection with the personal past. An ethnographic study in seventeen British households uncovered the role of mementos in the family home. By exploring the type, location and function of photo mementos, we explored their relation with other objects of memory and the surrounding space, clarifying their significance and function in different parts of the family home. Photo mementos are special, explicitly selected from hundreds of other images, they are often framed and arranged in clusters; they are mixed with other valuable

objects of memories to create autotopographies, i.e. autobiographies expressed through objects instead of narrative. Photo mementos can also change function, moving from being decorative to promoting conversation, supporting natural reminiscing as well as the construction of meanings and family values across generations. In summary, photo mementos are substantially different from other photos, e.g. photos in albums, and from digital photos in the computer. Our analysis uncovered four distinct functions of photo mementos: single photos in frames that serve to evoke private memories; clusters that signal themes for conversation in family areas; aesthetic photos that express hidden values, but that promote conversation in public areas; and memory boxes for private, infrequent immersive experiences.

We discuss important considerations for the design of photo technology in the home: such technology has to fit with home aesthetic and family practice. Our analysis shows that there is space for designing digital technology that addresses the specificity of highly affective photos that are blended with the family home and its order. We propose some design concepts to explore the possibilities offered by our novel findings to new forms of digital photo display that are empathic and affective, while fitting into the existing fabric of the home.

ACKNOWLEDGEMENTS

Petrelli and Whittaker were supported by the EU Marie Curie grant Memoir: MTKD-CT-2005-030008. We are grateful to all participants for their enthusiasm in opening their homes and sharing their thoughts.

REFERENCES

- Archer, B., (1995). The nature of research. *Co-design*, (2), pp.6–13.
- Bachelard, G. (1969) *The poetics of space*. Beacon Press.
- Banks, R., Sellen, A. (2009) Shoebox: Mixing Storage and Display of Digital Images in the Home. Proceedings of the 3rd International Conference on Tangible and Embedded Interaction (TEI'09), Feb 16-18 2009, Cambridge, UK, 35-40.
- Binder, T. & Redström, J., (2006). Exemplary Design Research. In *Proceedings of Wonderground: 2006 Design Research Society Conference*. Lisbon, Portugal.
- Bowen, S.J., (2009). *A Critical Artefact Methodology: Using Provocative Conceptual Designs to Foster Human-centred Innovation*. PhD Thesis. Sheffield, UK: Sheffield Hallam University.
- Bowen, S. & Petrelli, D., (2011). Remembering today tomorrow: Exploring the human-centred design of digital mementos. *International Journal of Human-Computer Studies*, 69(5), pp324-337.
- Brockmeier, J. (2010) After the Archive: Remapping Memory. *Culture Psychology*, 16 (5), 5-35.
- Chalfen, R. (1987) *Snapshots Versions of Life*. 1987. Popular Press.
- Chen, C., Oakes, M. P., Tait, J. (2006) Browsing personal images using episodic memory (time + location). Proc. of European Conference on Information Retrieval - ECIR 2006, 362-372.
- Cohen KR (2005) What does the photoblog want? *Media, Culture and Society*, 27, pp 883-901.
- Cooper, M., Foote, J., Girgenshon, A., Wilcox, (2005) Temporal event clustering for digital photo collections. *ACM Transactions on Multimedia Computing, Communications, and Applications (TOMCCAP)*, 1 (3), 269-288.
- Crabtree, A., Rodden, T., Mariani, J. (2004) Collaborating around collections: informing the continued development of photoware, Proc. CSCW, 396-405.

Csikszentmihalyi, M. and Rochberg-Halton, E. (1981) *The meaning of things – Domestic symbols and the self*. Cambridge University Press.

Drazin, A. and Frohlich, D. (2007) Good Intentions: Remembering through Framing Photographs in English Homes. *Ethnos*, 72 (1), 51-76.

Durrant, A., Taylor, A., Taylor, S., Molloy, M., Sellen, A., Frohlich, D., Gosset, P and Swan, L. (2008) Speculative Devices for Photo Display. *Proc. of Conference on Human Factors in Computing Systems CHI 2008 – Extended Abstracts*, 2297-2302.

Durrant, A., Frohlich, D., Sellen, A., Lyons, E. (2009) Home curation versus teenage photography: Photo displays in the family home. *International Journal of human Computer Studies IJHCS*, 67, 1005-1023.

Edwards, E., and Hart, J. (2004) Photographs as objects. in Edwards, E., and Hart, J. (eds) *Photographs objects histories: On the materiality of images*. Routledge.

Frayling, C., (1994). Research in art and design. *Royal College of Art Research Papers*, 1(1), pp.1–5.

Frohlich D (2004) *Audiophotography: Bringing Photos to Life with Sounds (The Computer Supported Cooperative Work Series)*, ISBN 1402023316, Springer-Verlag: Berlin.

Frohlich, D., Fennell, J. (2007) Sound, paper and memorabilia: resources for a simpler digital photography. *Personal and Ubiquitous Computing*, vol. 11, 107-116.

Frohlich, D. and Kraut, R. (2003) The social context of home computing. In Harper, R. (ed.) *Smart Homes*, Springer, 127-162.

Frohlich D, Kuchinsky A, Pering C, Don A, Ariss S (2002) *Requirements for photoware*, In: *Proceedings of the 2002 ACM Conference on Computer Supported Cooperative Work (CSCW'02)*, New Orleans, Louisiana, USA, New York: ACM Press, pp 166-175.

Frohlich, D. and Murphy, R. (2000) The Memory Box. *Personal Technologies*, 4, 238-240.

Gaver, W., (2012). What should we expect from research through design? In *Proceedings of CHI 2012*. pp. 937–946.

Gedenryd, H., 1998. *How designers work*. Sweden: Lund University. Available at: <http://www.lu.se/o.o.i.s?id=12588&postid=18828> [accessed 27.4.2012]

Gonzalez, J. A. (1995) Autotopographies. In Braham, G. and Driscoll, M. 'Prosthetic Territories – Politics and Hypertechnologies', Westview Press.

Hallnäs, L. and Redström, J. (2000) Slow Technology: Designing for Reflection. *PUC Journal of Personal and Ubiquitous Computing*, 5 (13), 201-212.

Hilliges, O., Baur, D., Butz, A. (2007) Photohelix: Browsing, Sorting and Sharing Digital Photo Collections. *Proc. TABLETOP07 2nd Annual IEEE International workshop on Horizontal Interactive Human-Computer Systems*, 87-94.

Holland, P. (2004) 'Sweet is to scan...' Personal photographs and popular photography. In Wells L. (ed.) *Photography: A critical Introduction*, 3rd ed., Routledge, 103-150.

Hoven, E. van den and Eggen, B. (2008) Informing Augmented Memory System design through Autobiographical Memory theory. *Personal and Ubiquitous Computing*, 12 (6), 433-443.

Lucero, A., Boberg, M., Uusitalo, S. (2009) Image Space: Capturing, Sharing and Contextualizing Personal Pictures in a Simple and Playful Way. *Proc. of ACM International Conference on Advances in Computer Entertainment Technology*, 215-222.

Lehmuskallio, A., Sarvas, R. (2008) Snapshot Video: Everyday Photographers Taking Short Video-Clips, *Proc. of ACM 5th Nordic conference on Human-computer interaction*, 257-265.

Kim, J. and Zimmerman, J. (2006) Cherish: Smart Digital Photo Frames for Sharing Social Narratives at Home. *Proc. of ACM International Conference on Human Factors in Computing Systems CHI 2006 – Extended Abstracts*, 953-958.

King, G. (1986). Say "Cheese". *The Snapshot As Art And Social History*. London, Collins.

Kirk D., Sellen A, Rother C, Wood K (2006) Understanding Photowork, In: *Proceedings of the ACM SIGCHI conference on Human factors in computing systems (CHI'06)*, Montreal, Canada, New York: ACM Press, pp 761-770.

Kirk, D., Izadi, S., Sellen, A., Taylor, A., Banks, R., Hilliges, O. (2010) Opening up the Family Archive. *Proc. of ACM International Conference on Computer Supported Cooperative Work CSCW10*, 261-270.

Martin, H. and Gaver, W. (2000) Beyond the snapshot: from speculation to prototypes in audiophotography. *Proc. of ACM International Conference on Designing Interactive systems, DIS*

McCracken, G. (2005). *Culture and Consumption II – Markets, Meaning, and Brand Management*. Bloomington, IN: Indiana University Press.

Naaman, M., Harada, S., Wang, Q., Garcia-Molina, H., Paepke, A. (2004) Context data in geo-referenced digital photo collections. *Proceedings of the 12th annual ACM international conference on Multimedia - MULTIMEDIA04*, 196-203.

Neustaedter, C., Fedorovskaya, E (2009) Understanding and Improving Flow in digital Photo Ecosystems. *Proc of Graphics Interface Conference 2009*, 191-198.

Nunes, M., Greenberg, S., Neustadter, C. (2009) Using physical memorabilia as opportunities to move into collocated digital photo-sharing. *International Journal of human Computer Studies IJHCS*, 67, 1087-1111.

Odom, W., Banks, R., Kirk, D., Harper, R., Lindley, S., and Sellen, A. (2012). Technology heirlooms?: considerations for passing down and inheriting digital materials. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '12)*. ACM, New York, NY, USA, 337-346.

Odom, W., Zimmerman, J., and Forlizzi, J. (2010). Virtual possessions. In *Proceedings of the 8th ACM Conference on Designing Interactive Systems (DIS '10)*. ACM, New York, NY, USA, 368-371

O'Hare, N., Gurrin, C., Jones, G., Smeaton, A. (2005) *Combination of content analysis and context features for digital photograph retrieval*. *Proc of 2nd European Workshop on Integration of Knowledge, Semantics and Digital Media Technology*, 2005. EWIMT 2005.

O'Hara, K., Helmes, J., Sellen, A., Harper, R., Bhomer, M., and van den Hoven, E. (2012). Food for talk: Phototalk and commensality, in *Human-Computer Interaction (Special Issue on Personal Memories)*, *Human Computer Interaction*.

Petrelli, D., Whittaker, S., and Brockmeier, J. (2008) AutoTopography: What Can Physical Mementos Tell us about Digital Memories? *Proc. of Conference on Human Factors in Computing Systems CHI 2008*, 53-62.

- Petrelli, D. and Whittaker, S. (2010) *Family Memories in the Home: Contrasting Physical and Digital Mementos*. Journal of Personal and Ubiquitous Computing, 14 (2), February 2010.
- Petrelli, D., Bowen, S.J., Dulake, N. and Light, A. (2012). Digital Christmas: an exploration of festive technology. In Proceedings of DIS '12. New York, New York, USA: ACM Press, pp. 348–357.
- Platt, J., Czenvinski, M., Field, B. (2003) *PhotoTOC: Automatic Clustering for Browsing Personal Photographs*. Proc. ICICS-PCM - IEEE 4th Pacific Rim Conference, 6-10.
- Price, D. (2004) Surveyors and Surveyed. In Wells L. (ed.) *Photography: A critical Introduction*, 55-102.
- Qui, Z., Doerthy, A., Gurring, C., Smeaton, A. (2011) *Mining User Activity as a Context Source for Search and Retrieval*. Proc. of 2011 International Conference on Semantic Technology and Information Retrieval.
- Rodden K, Wood KR (2003) How do people manage their digital photographs? In: Proceedings of the ACM SIGCHI conference on Human factors in computing systems (CHI '03), New York, NY, USA: ACM Press, pp 409–416.
- Sarvas, R. and Frohlich, D. (2011) *From Snapshots to Social Media - The Changing Picture of Domestic Photography*. Springer.
- Sawant, N., Li, J., Wang, J. (2011) Automatic image semantic interpretation using social action and tagging data. Journal of Multimedia Tools and Applications, Springer, 51 (1), 213-246.
- Shen, C., Lesh, N., and Vernier, F. (2003) Personal Digital Historian: Story Sharing Around the Table. Interactions, March + April, 15-22.
- Stevens, M., Abowd, G., Truong, K. and Vollmer, F. (2003) Getting into the Living Memory Box: Family archives & holistic design. Personal and Ubiquitous Computing, 7, 210-216.
- Strain, J. (2003) Households as Morally Ordered Communities: Explorations in the Dynamics of Domestic Life, in R. Harper (ed.) *Smart Homes*, Springer, 41-62.
- Susani, M. (1994) The sensible home. Proc. of 2nd Doors of Perception Conference.
- Swan, C. and Taylor, A. (2008) Photo Displays in the Home. Proc. of Designing Information Systems DIS 2008, 261-270.
- Taylor, A., Swan, S., and Durrant, A. (2007) Designing Family Photo Displays. Proc. of ECSCW 2007, Springer-Verlag Press, 79-99.
- Terrenghi, L., Kirk, D., Sellen, A., Izadi, S. (2007) Affordances for manipulation of physical versus digital media on interactive surfaces. In: Proceedings of the ACM SIGCHI conference on Human factors in computing systems (CHI '07), 1157-1166.
- Van Dijck, J. (2007). *Mediated Memories in the Digital Age*. Stanford: Stanford University Press.
- Van House (2009) Collocated photo sharing, story-telling, and the performance of self. International Journal of human Computer Studies IJHCS, 67, 1073-1086.
- Wells, L. (ed.) (2004) *Photography: A Critical Introduction*. Routledge.
- Whittaker, S., Bergman, O., and Clough, P. (2010). Easy on That Trigger Dad: A Study of Long Term Family Photo Retrieval. Personal and Ubiquitous Computing, 14, 31-43.

Zhang, L., Hu, Y., Li, M., Ma, W., Zhang, H. (2005) Efficient propagation for face annotation in family albums. Proceedings of the 12th annual ACM international conference on Multimedia - MULTIMEDIA04, 716-723.